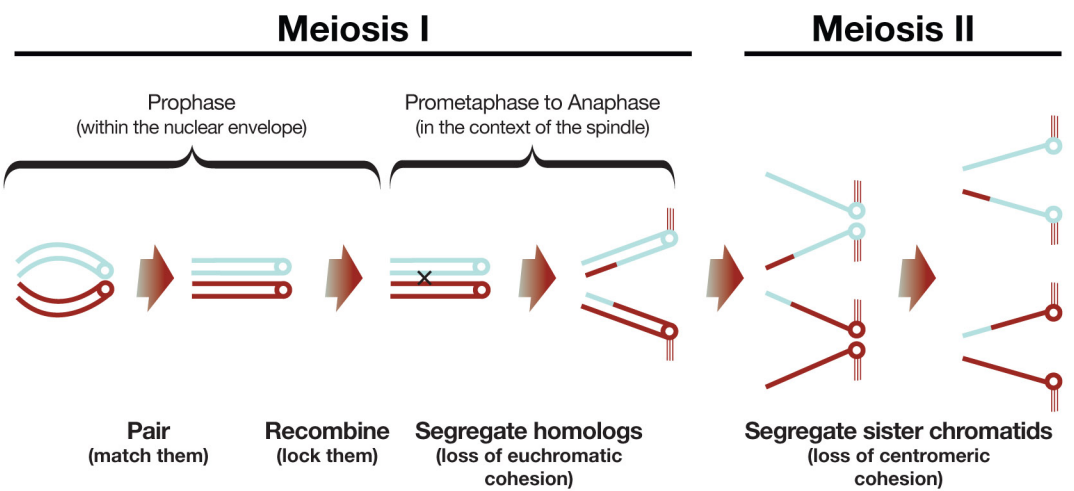

Figure 9. A Mechanistic View of the Meiotic Process

A pair of homologous chromosomes must do three things during the first meiotic division. First, the homologs must pair along their length. In virtually all organisms, this pairing culminates in an intimate association in which the homologs are connected along their entire length by the synaptonemal complex. This state is referred to as synapsis. Second, in virtually all organisms, homologous chromosomes are locked together by recombination, which is also called crossing-over. These exchange events (crossovers) form structures called chiasmata that physically interlock the homologous chromosomes by virtue of the sister chromatid present on each homolog on both sides of the crossover event. Both pairing and recombination occur during prophase (prior to nuclear envelope breakdown). The third major event, segregation, occurs on the MI spindle, which is created after nuclear envelope breakdown. During the early stages of spindle assembly (prometaphase), the chromosomes congress to create the metaphase plate. In most animals, males contain centriolar meiotic spindles, whereas in most animal females, the spindle is acentriolar. In this case, the chromosomes themselves form a mass at what will eventually become the metaphase plate, and organize a bipolar spindle around them. Once the chromosomes are properly co-oriented (i.e., balanced at the metaphase plate with homologous kinetochores attached to opposite poles of the spindle), a variety of mechanisms trigger the onset of anaphase. At anaphase, sister chromatid cohesion is released along the arms of the chromosomes (but not near the centromeres). This dissolves the connections, referred to as chiasmata, created by the crossovers, and thus allows the homologs to separate and proceed to opposite poles at anaphase I. Meiosis II is basically a haploid mitosis that occurs without either replication or recombination.